# A review of the recent research progress on risk factors of lung cancer

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**Abstract.** As a malignant tumor, Lung cancer has the highest morbidity and mortality rate worldwide. Various risk factors can cause lung cancer, of which the etiological structure is complicated and the specific mechanism has not been clarified yet. In this paper, the author reviews the recent research progress on risk factors of lung cancer, and conclusions can be drawn that smoking is currently the main risk factor causing lung cancer. The risk of developing lung cancer for smokers is 22 times higher than that of non-smokers. Another risk factor is known as indoor air pollution such as formaldehyde released by furniture and household air pollution (HAP). The majority of recent investigations confirm that indoor air pollution is connected to the development of lung cancer. In addition, previous research has also demonstrated a connection between lung cancer and a number of respiratory illnesses, especially chronic obstructive pulmonary disease (COPD). Moreover, a family history of tumors can also be a risk factor, for both men and women are at an increased risk of developing lung cancer if there is a history of the disease in close relatives. What is more, recent research also proves that the intake of fruits and vegetables can lower the incidence of lung cancer.


**Keywords:** lung cancer, risk factors, etiology, research progress.


## 1. Introduction

Based on epidemiological research, the interaction of genetics and environments is still the major risk factor that leads to the occurrence and development of lung cancer. At present, in addition to smoking-associated factors, it is difficult to explain how the incidence of lung cancer is related to genetics, food, chronic lung disorders, environmental and occupational exposure, and poor habits [1]. There were 18.1 million new cases of cancer worldwide in 2018, according to GLOBOCAN 2018, a report from the International Agency for Research on Cancer, a division of the World Health Organization (WHO). Based on the data collected on 36 types of cancer in 185 nations, 9.6 million people annually die from cancer, and Asian people represent over half of all cancer cases. Besides, Lung cancer has the highest incidence and mortality rates among mixed-gender populations (11.6% of all cases and 18.4% of all cancer-related deaths, respectively) [2]. In 2014, there were 626,000 lung cancer fatalities and 781,000 new cases, according to the National Tumor Registration Center. Lung cancer continued to be a leading cause of death for both sexes between 2000 and 2014, ranking first among malignant tumors during that time [3]. The total incidence of lung cancer also exhibited an upward trend during that time period.

This paper discusses recent findings on a few risk factors for lung cancer, including smoking, indoor air pollution, a history of lung chronic disease, a family history of the disease, diet, and nutrition, so as to offer a theoretical foundation for early detection, diagnosis, and treatment of lung cancer.

## 2. Smoking

According to the research conducted both domestically and abroad, smoking is currently the main reason for the development of lung cancer. According to a 2017 estimate from an American study, 19.3% of American adults (about 47.4 million) used tobacco. 86.7% (about 41.1 million) of them used combustible tobacco products and 19.0% (about 9 million) of them used two or more types [4]. WHO noted in the 2019 World No Tobacco Day promotion that 1.2 million people die annually from smoking-related lung cancer; compared to non-smokers, smokers are at a 22 times greater risk of developing lung cancer [5].

Based on the identification and quantitative analysis of the risk factor data of lung cancer in the elderly population in the U.S. Behavioral Risk Factor surveillance system, Chen et al. [6] showed in their study that the main risk factor for lung cancer in men aged 65 and over is the frequency of smoking. Significant risk factors for lung cancer in women aged 65 and over include the length of smoking cessation and whether they have at least 100 cigarettes smoked. It has been determined that smoking-related variables are the primary causes of lung cancer in older people. Environmental tobacco contamination poses a serious danger of lung cancer. Lung cancer risk was 30 percent higher for nonsmokers exposed to second-hand smoke at home or work [4].

Environmental tobacco smoke (ETS) is linked to dose exposure in women with lung cancer, according to domestic studies in Shenyang [7] and Tangshan [8] in China. This association has been comprehensively reviewed. The primary risk factor for lung cancer in women is high-dose ETS exposure, particularly over a 20-year period.

Another major research focus on the effects of environmental tobacco pollution is the link between exposure to third-hand smoke (tobacco residue) and lung cancer. According to a study by Moon et al. [9], third-hand smoke is easily inhaled by people who frequently use public transportation, saunas, bars, and Internet cafes. It is also easily inhaled by people who have recently gone through a divorce or a loss, who have low levels of education, or who have smokers in their homes.

Currently, only in vitro and animal studies have shown the impact of third-party smoking on the body; further research is needed to determine whether it can induce lung cancer [10].

## 3. Indoor air pollution

Household air pollution (HAP), formaldehyde released by furniture, and nitrogen oxides created by gas installations are all examples of indoor air pollution. The majority of recent investigations confirm that HAP is connected to the incidence of lung cancer. HAP is mostly caused by the use of biomass (including wood, charcoal, straw, and animal waste), coal, and other solid fuels for heating or cooking in small spaces in China, particularly in the northern regions.

The lung cancer mortality rate in Xuanwei City, Yunnan Province is among the highest in China. The substantial pollution brought by burning bituminous coal in a nearby indoor fireplace without a chimney has been demonstrated in prior research to be the main reason for the high mortality rate of lung cancer in the Xuanwei area. Liu et al. [11] discovered that although the incidence of lung cancer in Xuanwei is still high and may be related to tobacco exposure, bituminous coal use, and occupational exposure of the Xuanwei population, the current distribution of bituminous coal use is no longer consistent with the distribution of high, middle, and low incidence areas of lung cancer.

According to a 2020 study by Liu et al. [12], tobacco exposure leads to a more significant risk of developing lung cancer compared to indoor air pollution since no coal was used more than 30 years ago. They discovered that indoor air pollution had a strong lagged effect on lung cancer risk in Xuanwei more than 30 years ago. According to studies, smoking or exposure to second-hand smoke can lessen the impact of indoor air pollution on lung cancer by up to 18 to 30%.

Cooking oil fumes can also cause lung cancer in women, regardless of the impact of smoking, according to Jia et al. [13], who investigate the association between cooking and lung cancer in adults. Additionally, improper ventilation when cooking may raise the risk of lung cancer.

## 4. Pulmonary history

Previous research has demonstrated a connection between lung cancer growth and a number of respiratory illnesses. COPD has been long considered one of the major risk factors for lung cancer.

In their investigation, Yang et al. [14] identified the shared etiological spectrum of COPD and lung cancer and hypothesized that COPD acts as a catalyst for the growth of lung cancer. According to studies, when smoking (or high cumulative smoking) and burning biomass (coal, wood, etc.), people with pre-existing COPD have a substantially greater risk of having lung cancer than those without COPD. Additionally, smoking, passive smoking, burning biomass, and the incidence of lung cancer are all mediated by COPD.

However, the study of Sandelin et al. [15] came to a different conclusion. Unlike some previous studies that suggested both COPD and asthma as independent risk factors for lung cancer, this large cohort study based on 19894 COPD patients concluded that the hazard ratio for patients with COPD complicated with asthma to have lung cancer was lower than that for patients with COPD alone.

## 5. A family history of tumors

Numerous earlier investigations on lung cancer have found that in non-smoking lung cancer patients, genetic sensitivity is connected to the phenomena of cancer family clustering. According to Lin et al. [16], people with a history of lung cancer or any other type of cancer are at a higher risk of having the disease, particularly if their mother had the disease in the past.

According to Yoshida et al. [17], both men and women are at an increasing risk of developing lung cancer if there is a disease history in close relatives. An elevated risk of lung adenocarcinoma in women was found to be significantly correlated with a parent's history of the disease; however, this correlation was only found in former smokers. For men with a family history of the disease, the risk of developing small-cell lung cancer and lung adenocarcinoma was considerably higher.

## 6. Nutrition and diet

Dietary pattern analysis is a new method for examining how diet affects cancer risk. It does not focus on specific nutrients or foods, but rather on the overall impact of a mixed diet.

According to Wang et al. [18], the intake of fruits and vegetables can lower the rate of developing lung cancer, and this link was more pronounced in women. According to a controlled investigation by Deneo-Pellegrini et al. [19] on 300 patients with lung squamous cell carcinoma and 600 patients in the control group, increased meat consumption dramatically raised the possibility of having lung cancer.

In a study by Mahabir et al. [20], 482,875 cancer-free participants participated in a 7-year questionnaire follow-up survey, during which time 7052 of them received a lung cancer diagnosis. The total intake of copper was protective for smokers and adenocarcinoma patients; the total intake of magnesium increased the rate of lung cancer in men and current smokers; the total intake of iron was inversely related to the incidence of lung cancer in women. The researchers found no evidence that the total intake of calcium, magnesium, iron, copper, selenium, or zinc (dietary plus supplements) was associated with the rate of lung cancer among all participants. In terms of dietary minerals, higher calcium intake was linked to a decreased risk of lung cancer in women, however, minerals from dietary supplements were not.

Wakai et al. [21] conducted an analysis using data from four cohort studies with more than 200,000 participants and more than 1700 lung cancer patients. The result findings revealed that the intake of fruits and vegetables can lower the mortality rate for lung cancer patients, particularly when they consume moderate amounts of fruits.

## 7. Conclusion

One of the major malignancies that pose the greatest threat to human life and health worldwide has always been lung cancer. The timely updating and investigation of lung cancer risk factors are crucial for the prevention and control of the occurrence and progression of lung cancer in light of the growth and development of society. Lung cancer is clearly influenced by smoking, second-hand smoke, and environmental tobacco exposure. There is a correlation between the occurrence of lung cancer and a history of lung-related disorders, indoor air pollution, family history of cancer, nutrition, and diet, but more research is still needed to determine the exact etiology. Making dietary adjustments is essential to lowering the risk of lung cancer, in addition to quitting smoking, lowering exposure to indoor pollutants, and raising health awareness among those with a family history of malignancies and lung cancer. Future multi-center, large-sample research is required to precisely determine the effect of diet and dietary practices on the risk of lung cancer and to motivate health professionals to counsel the populace on healthy diets. Lung cancer occurs as a result of a variety of elements acting together, in addition to those mentioned above, and its etiology includes a broad spectrum of causes. More in-depth exploration still needs to be done by being combined with a variety of disciplines, so as to provide scientific guidance for the prevention of lung cancer.

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